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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification A23G 3/30		A1	(11) International Publication Number: WO 95/00039
			(43) International Publication Date: 5 January 1995 (05.01.95)
(21) International Application Number: PCT/US94/06971			(81) Designated States: AU, CA, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i>
(22) International Filing Date: 20 June 1994 (20.06.94)			
(30) Priority Data: 08/081,535 <u>23 June 1993 (23.06.93)</u> US			
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(54) Title: CHEWING GUM CONTAINING HYDROPHOBIC FLAVORANT ENCAPSULATED IN A HYDROPHILIC SHELL			
(57) Abstract Disclosed is chewing gum containing a flavoring component in which the flavorant is encapsulated in a hydrophilic shell.			

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CHEWING GUM CONTAINING HYDROPHOBIC
FLAVORANT ENCAPSULATED IN A HYDROPHILIC SHELL

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BACKGROUND OF THE INVENTION

The present invention relates to chewing gums. It relates in particular to gums and candy containing flavorants, and particularly flavorants of natural or artificial origin. The invention relates more particularly to gums having a particular flavoring component which comprises a specially prepared combination of flavorant and encapsulating agent.

The pertinent literature describes gum formulations in which the flavorant is entrapped, encapsulated, impregnated within porous microbeads or is otherwise physically surrounded. One example is U.S. Patent No. 5,128,155 which describes a chewing gum having a flavor releasing composition comprising a cellulosic material, a silica and a flavoring agent. The cellulosic material or other thermoplastic or thermosetting material is required by this patent to be present in the core which contains the flavoring agent. Thus, the constituent embodying the flavoring agent comprises several ingredients which are otherwise inert to the gum. The cellulosic or equivalent material, particularly when present simultaneously with silica in the gum, poses the risk of detracting from the desirable texture when chewed. This aspect seriously undermines the attractiveness of the purported advantage described in U.S. Patent No. 5,128,155, since a gum which is gritty or otherwise has an unattractive texture in the

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1 mouth will not be purchased regardless of how the flavor
is presented in the gum.

U.S. Patent No. 4,001,438 discloses flavor
compositions useful in chewing gums. Here, also, the
5 flavoring component requires the presence of a solid
suspending agent such as colloidal silica, xanthin gum
or ethyl cellulose. Thus, the flavor-bearing
constituent to be incorporated into the gum is required
by this patent to be composed of a multiplicity of
10 ingredients which do not otherwise contribute to the
desirable characteristics of the gum such as texture or
flexibility.

U.S. Patent No. 4,963,369 discloses a chewing
gum in which flavor ingredients are impregnated into
15 porous polymeric beads. This patent is yet another
example of gum formulations containing components in
which the flavoring ingredient is physically trapped.

Those familiar with the manufacture of chewing
gums and confections are aware that flavoring agents can
20 be vulnerable to gradual degradation in finished
products. This degradation can even be accelerated
through mediation by one or more other ingredients
present in the product. By "mediation" is meant that
the presence of such other ingredient(s) in the form in
25 which it or they are present appears to accelerate the
decomposition of the flavoring agent, regardless of
whether the mechanism of decomposition is chemical
reaction, catalysis of reaction with other components,
oxidation, or otherwise. The products which have the
30 potential for mediating the degradation of the
flavorants include sweeteners or other agents whose
presence is obviously desirable in the final product.

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1 Past attempts to prevent or retard degradation of the
flavorants have generally involved physically separating
or isolating the flavorants within the formulation, by
means such as encapsulation or other physical entrapment
5 mechanisms, in order to enable the flavorants present to
contribute as fully as desired to the flavor of the
final product.

It is also recognized in this art that the
consumer's perception of the flavorant(s) upon chewing
10 is important to the acceptance of the gum or confection
by the consumer. Attributes including the initial
impact of flavor upon the onset of chewing, and the
extension of duration of the flavor during chewing, are
particularly important. Achieving a desirable balance
15 of both properties is a challenge, particularly since it
is frequently found that techniques which enhance one
such property do so to the detriment of the other.

Thus, there is a need for chewing gum
compositions which satisfy the objectives of exhibiting
20 a sufficient degree of initial flavor impact while
protecting, and even enhancing, flavor extension and the
stability of the flavorants present.

BRIEF SUMMARY OF THE INVENTION

25 The present invention meets the aforementioned
objectives as well as other desired characteristics that
will be apparent.

In one aspect, the present invention comprises
30 a chewing gum comprising a gum base, a flavoring
component, and optionally a sweetening component,
wherein the flavoring component consists of particles of

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1 one or more hydrophobic flavorants encapsulated in a
hydrophilic shell.

Another aspect of the invention is an improved
method of making chewing gum by combining in any
5 sequence gum base, a flavoring component as described
herein, and, optionally, a sweetening component. The
gum made by this method provides strong initial flavor
impact, extends the flavor, reduces plasticization of
the gum by the flavorant, and retards or prevents
10 oxidative degradation of the flavorant.

DETAILED DESCRIPTION OF THE INVENTION

The invention will be described with respect
15 to its embodiment in chewing gums, by which is meant
gums in all forms whether sugar-containing or sugar-
free, bubble gum or conventional chewing gum, and the
like. The chewing gum of the present invention
comprises the gum base itself, optional solvents, and/or
20 plasticizers. The amount of gum base employed will vary
greatly depending on various factors such as the type of
base used, consistency desired and other components used
to make the final product. In general, amounts of about
5% to about 50% by weight of the final chewing gum
25 composition are acceptable for use in the chewing gum
compositions, preferred amounts thereof being about 15%
to about 25% by weight.

The gum base may be any water-insoluble gum
base well known in the art. Illustrative examples of
30 suitable polymers in gum bases include both natural and
synthetic elastomers and rubbers. For example, those
polymers which are suitable in gum bases include,

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- 1 without limitation, substances of vegetable origin such
as chicle, jelutong, gutta percha and crown gum.
Synthetic elastomers such as butadiene-styrene
copolymers, isobutylene-isoprene copolymers,
5 polyethylene, polyisobutylene and polyvinyl acetate, and
mixtures thereof, are particularly useful.

The gum base composition may contain elastomer
solvents to aid in softening the rubber component. Such
elastomer solvents may comprise methyl, glycerol or
10 pentaerythritol esters of rosins or modified rosins,
such as hydrogenated, dimerized or polymerized rosins,
or mixtures thereof. Examples of elastomer solvents
suitable for use herein include the pentaerythritol
ester of partially hydrogenated wood rosin,
15 pentaerythritol ester of wood rosin, glycerol ester of
partially dimerized rosin, glycerol ester of polymerized
rosin, glycerol ester of tall oil rosin, glycerol ester
of wood rosin and partially hydrogenated wood rosin and
partially hydrogenated methyl ester of rosin, such as
20 polymers of alpha-pinene or beta-pinene; terpene resins
including polyterpene; and mixtures thereof. The
solvent may be employed in an amount ranging from about
10% to about 75% and preferably about 45% to about 70%
by weight to the gum base.

- 25 The gum base can also contain any of a variety
of traditional ingredients such as plasticizers or
softeners such as lanolin, stearic acid, sodium
stearate, potassium stearate, glyceryl triacetate,
glycerine and the like and/or waxes, for example,
30 natural waxes, petroleum waxes, such as polyethylene
waxes, paraffin waxes and microcrystalline waxes, to
obtain a variety of desirable textures and consistency

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1 properties. These individual additional materials are
generally employed in amounts of up to about 30% by
weight and preferably in amounts of from about 3% to
about 20% by weight of the final gum base composition.

5 The chewing gum composition may additionally
include conventional additives such as emulsifiers such
as lecithin and glyceryl monostearate; and additional
fillers such as aluminum hydroxide, magnesium hydroxide,
alumina, aluminum silicates, calcium carbonate, and talc
10 and combinations thereof. These fillers may be used in
the gum base in various amounts. Preferably the amount
of fillers when used will vary from about 4 to about 30%
by weight of the final chewing gum.

The chewing gums of this invention also
15 contain a flavoring component which comprises particles
of a hydrophobic flavorant encapsulated in a shell of a
hydrophilic material.

Suitable flavorants include both natural and
artificial flavors and mints, such as oil of peppermint,
20 menthol, oil of spearmint, vanilla, oil of cinnamon, oil
of wintergreen (methyl salicylate), and various fruit
flavors, including but not limited to lemon oil, orange
oil, grape flavor, lime oil, grapefruit oil, apple,
apricot essence, and combinations thereof. The
25 flavorings are generally utilized in amounts that will
vary depending upon the individual flavor. Optionally,
a small amount of a vegetable oil or equivalent material
can be added to the flavor oil when it is desired to
lessen any overly strong impact of the flavor.

30 The flavoring component of the gums of the
present invention (i.e. flavorant plus shell) preferably
comprises about 0.005% to about 3.0% by weight of the

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1 final chewing gum product. The flavoring component, in
turn, preferably comprises about 20 to about 90% by
weight flavorant, and the balance the shell.

5 The shell is composed of any hydrophilic, or
water-soluble, shell-forming material, such as gelatin,
agar, shellac, gum arabic, alginic acid and salts
thereof, and xanthan gum. Mixtures of any of the
foregoing can also be used.

10 The present invention contributes ease and
economy of formulation, with an unprecedented
realization of benefits. Those benefits include
unimpeded onset of flavor during the initial chew
coupled with a prolonged extension of the flavor effect
during chewing, all of which are realized together with
15 the full, undegraded effect of the flavoring component.
Other benefits include lessening of the plasticization
of the gum base by the flavorant, and retarded or
eliminated oxidation of the flavorant.

Notably, the use of the encapsulated flavoring
20 component as described herein permits attainment of a
given level of flavor perception with less flavorant;
that is, the availability of the flavorant appears
enhanced. Indeed, gums of the present invention achieve
far greater flavor impact than is achievable by other
25 known flavoring techniques. This advantage is
particularly unexpected since the shell would be thought
to introduce around the flavor a barrier to flavor
perception which is not present in conventional gums.
Without being bound by any particular theory, it is
30 believed that the encapsulated flavorant is less likely
to be masked within the gum base, by absorption into the
gum base or otherwise; under this theory, a greater

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1 proportion out of any total loading of flavor is
"available" for perception by the consumer. In
conventional gum formulations wherein the flavorants are
not encapsulated, certain components of the flavorant
5 can become entrapped in the gum base; or, components of
the flavorant can be lost during processing of the gum.
The result can be an unwanted change to the character of
the flavor.

The present invention minimizes these
10 problems. In addition, particularly when the present
invention is carried out using liquid flavorant oils or
solutions, the present invention permits the operator to
avoid unwanted loss of flavor components if the operator
chooses to dry (spray-dry) the flavorant. This, in
15 turn, reduces the cost of the operation and permits
retention of the more volatile components of the
flavorant, as drying generally requires the application
of heat which absent the encapsulating shell would drive
off the more volatile components and could even alter
20 the structure of flavor components. As a result, the
perceived flavor is stronger and fuller.

Preparation of the encapsulated flavoring
component used in the present invention can be carried
out by the techniques described in European Patent
25 Application No. 89303098.1, the content of which is
hereby incorporated herein by reference. In general, an
aqueous solution is formed of hydrophilic material such
as gelatin, gum arabic, agar, shellac, or a mixture of
two or more of these. Then, hydrophobic flavorant is
30 added in small droplet amounts. It is often
advantageous to add a small amount of a food grade
emulsifier such as lecithin or a monoglyceride or

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1 diglyceride, sorbitan monostearate, or polysorbate 60,
and then to agitate and emulsify the system. Using
gelatin as an example of a hydrophilic shell material,
the gelatin is then caused to turn into a solid by one
5 of several techniques, such as:

1. pH adjustment to the isoelectric point of
the gelatin, typically pH 4.8 using a dilute acid,
2. Increasing the osmotic pressure by slow
addition of a salt that causes the gelatin to
10 precipitate, such as sodium citrate,
3. Slow addition of a polymer nonsolvent that
causes the polymer (gelatin in this case) to thicken and
form a solid. Ethanol could be used in this example.
4. Slow cooling of the system so the gelatin
15 would set up.

Another process of interest would involve
complex coacervation. Here a mixture of e.g. 1% gelatin
and 1% gum arabic are mixed with peppermint oil.
Gelatin can have a range of isoelectric points from 4 to
20 9, depending on the procedure used in making it.
Assuming that the gelatin has an isoelectric point of
4.8, then above a pH of 4.8, the gelatin is negatively
charged. Below pH 4.8, the gelatin is positively
charged. By contrast the gum arabic contains many
25 carboxylic acid groups. Therefore it is negatively
charged. When the mixture is made, the pH should be
above pH 4.8, so both the gelatin and the gum arabic are
negatively charged. At this point they do not react
with each other. Then acetic acid, or dilute
30 hydrochloric acid is added. As the pH drops below pH
4.8, the gelatin becomes positively charged and is
therefore attracted to the gum arabic. They therefore

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1 precipitate and form a shell around the peppermint oil.
This would provide a stronger shell than one containing
gelatin alone.

The particles, however formed, can then be
5 recovered e.g. by filtration or centrifugation, and then
dried, for instance in a spray dryer or a fluid bed
dryer.

The particles can generally be about 0.1 mm to
about 3.0 mm in diameter; since these limits are not
10 believed to be critical, particle diameters outside this
range are believed useful. Preferably a greater
fraction or all of the particles are about 0.1 mm to
about 1.0 mm in diameter. It will be recognized that a
gum formulation can contain particles having a range of
15 different diameters.

Relative amounts of flavorant to shell can be
adjusted depending on the desired taste characteristics
of the final product. It is a significant and
unexpected advantage of this invention that the
20 advantages described herein can be realized over a wide
range of ratios of flavorant to shell.

The present invention contemplates the
optional inclusion in the chewing gum of a sweetener
component which comprises any one or more sweeteners
25 known in the art, including both natural and artificial
sweeteners. Thus, sweeteners may be chosen from the
following non-limiting list, which includes sugars such
as sucrose, glucose, corn syrup, dextrose, invert sugar,
fructose and mixtures thereof; saccharine and its
30 various salts such as the sodium or calcium salt;
cyclamic acid and its various salts such as the sodium
salt; free aspartame; dihydrochalcone sweetening

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1 compounds; glycyrrhizin; Stevia rebaudiana (Stevioside);
monellin, thalmatin, Sucralose, neosugar, and
polydextrose; and sugar alcohols such as sorbitol,
sorbitol syrup, mannitol, xylitol, isomaltitol,
5 lactitol, maltitol, and the like. Also contemplated as
a sweetener is the nonfermentable sugar substitute
hydrogenated starch hydrolysate (also known as Lycasin)
which is described in U.S. Pat. No. Re. 26,959. Also
contemplated is the synthetic sweetener 3,6-dihydro-6-
10 methyl-1-1,2,3-oxathiazin-4-one-2,2-dioxide,
particularly the potassium (Acesulfame-K), sodium and
calcium salts thereof as described in German Patent No.
2,001,017.7.

As indicated, products within the scope of the
15 present invention may include no sweetener at all. If
sweetener is included, the amount of sweetener is
effective to provide the desired degree of sweetness,
generally 0.001 to 70 wt.% of the final product.
Colorants can be present in the chewing gums and
20 confections of the present invention. Examples include
the pigments such as titanium dioxide and other dyes
suitable for food, drug and cosmetic applications known
as F.D. & C. dyes, and the like. The materials may be
incorporated in amounts of up to about 6% by weight,
25 preferably under about 1% by weight.

Chewing gums in accordance with the present
invention are formulated in accordance with essentially
conventional processing technology. Thus, preferably,
the gum base including any resins, plasticizers, fillers
30 and/or other gum base components are softened together
by heating and then mixed together with the flavoring
component, and the mixture is stirred together for a

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1 time sufficient to insure a homogenous mass. The mass
can be formed into pellets or into slabs from which
individual stick-type pieces are cut using technology
familiar to those skilled in this art.

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EXAMPLE

Chewing gum is prepared from the components set forth in the following Table 1:

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TABLE 1 (all amounts in wt. %)	
Component	Amount
Sorbitol powder	42.6%
Gum base	30.0
Hydrogenated glucose syrup	17.0
Glycerin	5.0
Sorbitol solution, 70%	4.0
Peppermint oil	1.0
Peppermint oil encapsulated in gelatin	0.1
Aspartame	0.3
TOTAL	100.00

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1 WHAT IS CLAIMED IS:

1. A chewing gum comprising a flavoring component, said flavoring component comprising particles having a hydrophilic shell encapsulating one or more
5 hydrophobic flavorants, wherein said one or more flavorants are releasable from said shell upon chewing of said gum.

2. A chewing gum according to Claim 1 wherein in said particles said flavorants comprise about
10 20 to about 90 wt.% thereof and said shell comprises about 10 to about 80 wt.% thereof.

3. A chewing gum according to Claim 2 wherein in said particles said flavorants comprise about
15 70 wt.% thereof and said shell comprises about 30 wt.% thereof.

4. A chewing gum according to Claim 1 wherein said particles comprise about 0.005 to about 3.0 wt.% of said gum.

5. A chewing gum or confection according to
20 Claim 1 wherein said flavorant is selected from the group consisting of peppermint oil, menthol, cinnamon oil, spearmint oil, vanilla, wintergreen oil, lemon oil, orange oil, grape, lime oil, grapefruit oil, apple, apricot essence, and mixtures thereof.

25 6. A chewing gum or confection according to Claim 1, further comprising a sweetener.

7. A chewing gum according to Claim 6 wherein said sweetener is selected from the group consisting of sucrose, glucose, corn syrup, dextrose,
30 invert sugar, fructose, saccharine, salts of saccharine, cyclamic acid, salts of cyclamic acid, aspartame, dihydrochalcones, glycyrrhizin, Stevia rebaudiana,

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1 monellin, thalmin, Sucralose, isomaltitol, neosugar,
lactitol, polydextrose, maltitol, sorbitol, sorbitol
syrup, mannitol, xylitol, hydrogenated starch
hydrolysate, Acesulfame, salts of Acesulfame, and
5 mixtures thereof.

8. A chewing gum according to Claim 1
wherein said shell is made of material selected from the
group consisting of gelatin, agar, shellac, gum arabic,
alginic acid and salts thereof, xanthan gum, and
10 mixtures thereof.

9. A chewing gum according to Claim 1
wherein particles comprising said flavoring component
have diameters of about 0.1 mm to about 3.0 mm.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US94/06971

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :A23G 3/30

US CL :426/5

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 426/3, 4, 5, 6, 96, 650,651

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 5,004,595 (CHERUKURI ET AL) 02 April 1991, see entire document.	1-9
Y	US, A, 4, 001,438 (MARMO ET AL) 04 January 1977, see entire document.	1-9
Y	US, A, 4,963,369 (SONG ET AL) 16 October 1990, see entire document.	1-9

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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L document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*G* document member of the same patent family
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Date of the actual completion of the international search

12 SEPTEMBER 1994

Date of mailing of the international search report

21 SEP 1994

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